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Application Number 09/396,266
Filing Date 09/15/1999
First Named Inventor Peterson
Group Art Unit 1713
Examiner Name C. Caixia Lu
Attorney Docket Number 1998U007A.US

Total Number of Pages in This Submission 29

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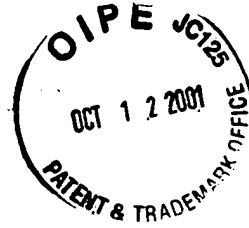
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APPEAL BRIEF

Before

Board of Patent Appeals and Interferences

in the

United States Patent and Trademark Office

Ex Parte

U.S. Serial No: 09/396,266

Inventor: Thomas H. Peterson

Title: Catalyst Composition for the Polymerization of Olefins

Attorney Docket No. 1998U007A.US

I. REAL PARTY IN INTEREST

Univation Technologies L.L.C.

II. RELATED APPEALS AND INTERFERENCES

No pending appeals or interferences are known to Appellants.

III. STATUS OF CLAIMS

In the Final Office Action mailed March 12, 2001, the pending claims were 1-3, 5-20 and 22-32.

The Final Rejection of claims 1-3, 5-20 and 22-32 is appealed.

A copy of the claims on appeal are appended to this brief.

IV. STATUS OF AMENDMENTS

No claim has been amended since the final rejection mailed March 12, 2001, (Paper No. 7).

V. SUMMARY OF THE INVENTION

The claimed invention is directed to a process for polymerizing olefins in the presence a catalyst composition comprising an activator and a mono-cycloalkadienyl catalyst precursor having the formula $CpD^a(JY)(Q)_{(a-2)}$, wherein Cp is a substituted cyclopentadienyl or a substituted or unsubstituted cycloalkadienyl group other than cyclopentadienyl or a related cycloalkadienyl cogener, each Q is independently an anionic leaving group, J is a Group 15, 16 or 17 atom, a is the oxidation state of D, D is a Group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic unsubstituted cyclopentadienyl group, M is not titanium, and Y is a heteroatom, a substituted heteroatom or a C₁ to C₁₀₀ hydrocarbyl group that may optionally contain one or more heteroatom(s).

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VI. ISSUES

The issues before the Honorable Board of Patent Appeals and Interferences are:

Whether the process claimed in claims 1-3, 5-20 and 22-32 is obvious under 35 U.S.C. § 103 (a) over Tsutsui *et al.* (US 5,700,750), referred to herein as Tsutsui *et al.*, and Campbell, Jr. (US 5,206,197), referred to herein as Campbell.

VII. GROUPING OF CLAIMS

The claims before the Honorable Board of Appeals and Interferences stand together.

VIII. ARGUMENTS

Claims 1-3, 5-20 and 22-32 have been finally rejected under 35 U.S.C. § 103 (a) as being unpatentable over Tsutsui *et al.* and Campbell. The rejection is respectfully appealed from.

The present invention claims a process for polymerizing olefins in the presence of a catalyst composition, having enhanced activity, including a catalyst precursor compound and an activator. The catalyst precursor is a substituted mono-cycloalkadienyl metal compound which also includes a ligand having the formula (JY) where J is a Group 15, 16 or 17 atom and where Y is a heteroatom, a substituted heteroatom or a C₁ to C₁₀₀ hydrocarbyl group that may optionally contain one or more heteroatom(s). In a preferred embodiment, JY is an alkoxide.

The claimed catalyst precursor is represented by the formula $\text{CpD}^a(\text{JY})(\text{Q})_{(a-2)}$, wherein Cp is a substituted cyclopentadienyl or a substituted or unsubstituted cycloalkadienyl group other than cyclopentadienyl or a related cycloalkadienyl cogener, each Q is independently an anionic leaving group, J is a Group 15, 16 or 17 atom, a is the oxidation state of D, D is a Group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic unsubstituted cyclopentadienyl group, M is not titanium, and Y is a heteroatom, a substituted heteroatom or a C₁ to C₁₀₀ hydrocarbyl group that may optionally contain one or more heteroatom(s). Unique to the catalyst precursor of the invention is the enhanced activity observed with a substituted mono-cycloalkadienyl catalyst precursor compound contains an alkoxide ligand.

As applicant understands, it is the Examiner's position that Tsutsui generically teaches the mono(cyclopentadienyl) compound of the invention and therefore it would have been obvious to a skilled artisan to arrive at the instant invention by using a mono(cyclopentadienyl) compound containing catalyst and expect it to work. In regard to Campbell, the Examiner states that a catalyst reactive toward styrene polymerization is expected to be more reactive toward olefin polymerization. Therefore, a skilled artisan will be motivated to use Campbell's monocyclopentadienyl compound containing catalyst system in search of a more reactive catalyst system towards olefins.

In response, applicant states that Tsutsui *et al.* expressly disclose bis(cyclopentadienyl) compounds and they do not suggest that the mono-cycloalkadienyl species recited in the instant claims are obvious. Nothing within the Tsutsui *et al.* disclosure would lead one of ordinary skill in the art to applicant's claimed substituted mono-cycloalkadienyl compounds or suggest that such compounds would have enhanced activity. The compounds listed in Tsutsui *et al.*, from Col. 5, line 63 carried over to Col. 6, line 43 are all bis(cyclopentadienyl) compounds. The only instances wherein R² of Tsutsui *et al.* is designated as an OR group the compound is a bis(cyclopentadienyl) compound. In addition, Tsutsui *et al.* teach how to synthesis the bis(cyclopentadienyl) compounds, but they do disclose or teach the preparation of mono Cp compounds. It is therefore respectfully submitted that, without the present disclosure, the Examiner has not provided the necessary motivation to go from the bis(cyclopentadienyl) compounds of Tsutsui *et al.* to the substituted mono-cyclopentadienyl catalyst compounds as recited in the instant claims.

In regard to Campbell, the present invention claims a catalyst precursor having single substituted cyclopentadienyl or a substituted or unsubstituted cycloalkadienyl group for the polymerization of alpha-olefins. In contrast Campbell utilizes unsubstituted cyclopentadienyl compounds for the polymerization of vinyl aromatic monomers, namely styrene. The claims do not read on any compound recited in Campbell.

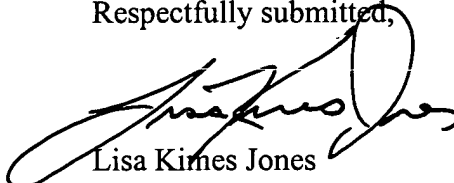
In addition, it is also respectfully submitted that it is well known in the polymerization arts that styrene and alpha-olefins polymerize by completely different mechanisms. It is also well know in the art that catalyst systems for the polymerization of olefins most often are not useful for the polymerization of styrene and visa versa. For

example, butyllithium is an effective catalyst for styrene polymerization, but ineffective for alpha-olefin polymerization. It is therefore submitted that the mere finding that alpha-olefins and styrene have vinyl groups does not provide the motivation of using or even trying a catalyst in an alpha-olefin process when found useful in a vinyl aromatic polymerization process. It is particularly noteworthy that Campbell's catalysts are useful for obtaining syndiotactic polymers, a property that would not at all be of interest in the polymerization of ethylene that is demonstrated in applicant's examples. It is therefore respectfully submitted that the Examiner has not provided any evidence of obviousness.

Finally, it is further submitted that the Examples in the instant application provide evidence of unobviousness over Campbell and Tsutsui. In Table 3 of applicant's specification, it is demonstrated that the catalysts comprising one substituted cyclopentadienyl group and an alkoxide ligand manifest activities that are unexpectedly greater than the catalysts comprising a single unsubstituted cyclopentadienyl group. For example 1b and 1c show an activity that is twice that of 1a; 2b shows an activity more than twice that of 2a. Similar results are found in the number 3 compounds.

In view of the above it is respectfully submitted that the Final rejection under 35 U.S.C. § 103 (a) over Tsutsui and Campbell should be reversed.

Respectfully submitted,



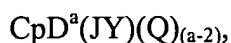
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IX. APPENDIX

Claims 1-3, 5-20 and 22-32, involved in this appeal, are listed below.

1. A process for the polymerization of olefins comprising contacting olefins with a catalyst system comprising an activator and a catalyst precursor represented by the formula:



wherein:

Cp is a substituted cyclopentadienyl or a substituted or unsubstituted cycloalkadienyl group other than cyclopentadienyl or a related cycloalkadienyl cogener, each Q is independently an anionic leaving group,

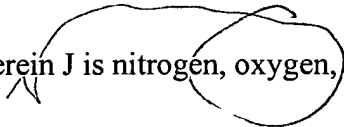
J is a Group 15, 16 or 17 atom,

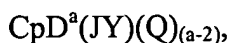
a is the oxidation state of D,

D is a Group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic unsubstituted cyclopentadienyl group, M is not titanium, and

Y is a heteroatom, a substituted heteroatom or a C₁ to C₁₀₀ hydrocarbyl group that may optionally contain one or more heteroatom(s).

2. The process of claim 1 wherein Cp is a substituted cyclopentadienyl group.
3. The process of claim 1 wherein Cp is an indenyl or fluorenyl group.
5. The process of claim 3 wherein the indene or fluorene is substituted.
6. The process of claim 1 wherein D is a Group 4 metal.
7. The process of claim 1 wherein D is zirconium or hafnium.

8. The process of claim 2 wherein D is zirconium.
9. The process of claim 1 wherein Y is a substituted or unsubstituted Group 13 - 17 heteroatom or a C₁ to C₄₀ alkyl, alkynyl, aryl, or arylalkyl group.
10. The process of claim 1 wherein Y is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.
11. The process of claim 1 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl, and perfluorobutyl, cyclopentyl, cyclohexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, dimethyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.
12. The process of claim 1 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine, 
13. The process of claim 1 wherein J is oxygen, nitrogen or sulfur.
14. The process of claim 1 wherein J is oxygen.
15. The process of claim 1 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.
16. The process of claim 1 wherein the process is a gas phase process.
17. The process of claim 1 wherein the process is a slurry phase process.
18. A composition comprising an activator and a catalyst precursor represented by the formula:



wherein:

Cp is a substituted cyclopentadienyl or a substituted or unsubstituted cycloalkadienyl group other than cyclopentadienyl or a related cycloalkadienyl cogener,

Each Q is independently an anionic leaving group,

J is a Group 15, 16 or 17 atom,

a is the oxidation state of D,

D is a Group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic unsubstituted cyclopentadienyl group, M is not titanium, and

Y is a heteroatom, a substituted heteroatom or a C₁ to C₁₀₀ hydrocarbyl group that may optionally contain one or more heteroatom(s).

19. The composition of claim 18 wherein Cp is a substituted cyclopentadienyl group.
20. The composition of claim 18 wherein Cp is an indenyl or fluorenyl group.
22. The composition of claim 20 wherein the indene or fluorene is substituted.
23. The composition of claim 18 wherein D is a group four metal.
24. The composition of claim 18 wherein D is zirconium or hafnium.
25. The composition of claim 19 wherein D is zirconium.
26. The composition of claim 18 wherein Y is a substituted or unsubstituted group 13-17 heteroatom or a C₁ to C₄₀ alkyl, alknyl, aryl, or arylalkyl group.

27. The composition of claim 19 wherein Y is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.
28. The composition of claim 19 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl, and perfluorobutyl, cyclopentyl, cyclohexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, dimethyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.
29. The composition of claim 18 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine.
30. The composition of claim 18 wherein J is oxygen, nitrogen or sulfur.
31. The composition of claim 18 wherein J is oxygen.
32. The composition of claim 18 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.